where the ''* * *'' are replaced with the tare mass in kilograms of the intermediate bulk container.

(4) For each fiberboard and wooden intermediate bulk container, the tare mass in kg must be shown.

(5) Each flexible intermediate bulk container may be marked with a pictogram displaying recommended lifting methods.

(6) For each composite intermediate bulk container, the inner receptacle must be marked with at least the following information:

(i) The code number designating the intermediate bulk container design type, the name and address or symbol of the manufacturer, the date of manufacture and the country authorizing the allocation of the mark as specified in paragraph (a) of this section;

(ii) Where the outer casing of a composite intermediate bulk container can be dismantled, each of the detachable parts must be marked with the month and year of manufacture and the name or symbol of the manufacturer.

[Amdt. 178–103, 59 FR 38068, July 26, 1994, as amended by Amdt. 178–119, 62 FR 24743, May 6, 1997]

### §178.704 General intermediate bulk container standards.

(a) Each intermediate bulk container must be resistant to, or protected from, deterioration due to exposure to the external environment. Intermediate bulk containers intended for solid hazardous materials must be sift-proof and water-resistant.

(b) All service equipment must be so positioned or protected as to minimize potential loss of contents resulting from damage during intermediate bulk container handling and transportation.

(c) Each intermediate bulk container, including attachments, and service and structural equipment, must be designed to withstand, without loss of hazardous materials, the internal pressure of the contents and the stresses of normal handling and transport. An intermediate bulk container intended for stacking must be designed for stacking. Any lifting or securing features of an intermediate bulk container must be of sufficient strength to withstand the normal conditions of handling and transportation without gross distortion or failure and must be positioned so as to cause no undue stress in any part of the intermediate bulk container.

(d) An intermediate bulk container consisting of a packaging within a framework must be so constructed that:

(1) The body is not damaged by the framework;

(2) The body is retained within the framework at all times; and

(3) The service and structural equipment are fixed in such a way that they cannot be damaged if the connections between body and frame allow relative expansion or movement.

(e) Bottom discharge valves must be secured in the closed position and the discharge system suitably protected from damage. Valves having lever closures must be secured against accidental opening. The open or closed position of each valve must be readily apparent. For each intermediate bulk container containing a liquid, a secondary means of sealing the discharge aperture must also be provided, e.g., by a blank flange or equivalent device.

(f) Intermediate bulk container design types must be constructed in such a way as to be bottom-lifted or top-lifted as specified in §§178.811 and 178.812.

### §178.705 Standards for metal intermediate bulk containers.

(a) The provisions in this section apply to metal intermediate bulk containers intended to contain liquids and solids. Metal intermediate bulk container types are designated:

(1) 11A, 11B, 11N for solids that are loaded or discharged by gravity.

(2) 21A, 21B, 21N for solids that are loaded or discharged at a gauge pressure greater than 10 kPa (1.45 psig).

(3) 31A, 31B, 31N for liquids or solids.

(b) Definitions for metal intermediate bulk containers:

(1) *Metal intermediate bulk container* means an intermediate bulk container with a metal body, together with appropriate service and structural equipment.

(2) *Protected* means providing the intermediate bulk container body with additional external protection against impact and abrasion. For example, a multi-layer (sandwich) or double wall

construction or a frame with a metal lattice-work casing.

(c) Construction requirements for metal intermediate bulk containers are as follows:

(1) *Body*. The body must be made of ductile metal materials. Welds must be made so as to maintain design type integrity of the receptacle under conditions normally incident to transportation.

(i) The use of dissimilar metals must not result in deterioration that could affect the integrity of the body.

(ii) Aluminum intermediate bulk containers intended to contain flammable liquids must have no movable parts, such as covers and closures, made of unprotected steel liable to rust, which might cause a dangerous reaction from friction or percussive contact with the aluminum.

(iii) Metals used in fabricating the body of a metal intermediate bulk container must meet the following requirements:

(A) For steel, the percentage elongation at fracture must not be less than 10,000/Rm with a minimum of 20 percent; where Rm = minimum tensile strength of the steel to be used, in N/mm$^2$; if U.S. Standard units of pounds per square inch are used for tensile strength then the ratio becomes 10,000 × (145/Rm).

(B) For aluminum, the percentage elongation at fracture must not be less than 10,000/(6Rm) with an absolute minimum of eight percent; if U.S. Standard units of pounds per square inch are used for tensile strength then the ratio becomes 10,000 × 145 / (6Rm).

(C) Specimens used to determine the elongation at fracture must be taken transversely to the direction of rolling and be so secured that:

$$Lo = 5d$$

or

$$Lo = 5.65\sqrt{A}$$

where:

Lo = gauge length of the specimen before the test
d = diameter
A = cross-sectional area of test specimen.

(iv) Minimum wall thickness:

(A) For a reference steel having a product of Rm × Ao = 10,000, where Ao = minimum elongation (as a percentage) of the reference steel to be used on fracture under tensile stress, (Rm × Ao = 10,000 × 145; if tensile strength is in U.S. Standard units of pounds per square inch) the wall thickness must not be less than:

| Capacity in liters [1] | Wall thickness in mm (inches) | | | |
|---|---|---|---|---|
| | Types 11A, 11B, 11N | | Types 21A, 21B, 21N, 31A, 31B, 31N | |
| | Unprotected | Protected | Unprotected | Protected |
| >450 and ≦1000 | 2.0 (0.079) | 1.5 (0.059) | 2.5 (0.098) | 2.0 (0.079) |
| >1000 and ≦2000 | 2.5 (0.098) | 2.0 (0.079) | 3.0 (0.118) | 2.5 (0.098) |
| >2000 and ≦3000 | 3.0 (0.118) | 2.5 (0.098) | 4.0 (0.157) | 3.0 (0.118) |

[1] Where: gallons = liters × 0.264.

(B) For metals other than the reference steel described in paragraph (c)(1)(iii)(A) of this section, the minimum wall thickness is the greater of 1.5 mm (0.059 inches) or as determined by use of the following equivalence formula:

*Formula for Metric Units*

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{Rm_1 \times A_1}}$$

*Formula for U.S. Standard Units*

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{(Rm_1 \times A_1)/145}}$$

where:

$e_1$ = required equivalent wall thickness of the metal to be used (in mm or if $e_o$ is in inches, use formula for U.S. Standard units).

$e_o$ = required minimum wall thickness for the reference steel (in mm or if $e_o$ is in inches, use formula for U.S. Standard units).

$Rm_1$ = guaranteed minimum tensile strength of the metal to be used (in $N/mm^2$ or for U.S. Standard units, use pounds per square inch).

$A_1$ = minimum elongation (as a percentage) of the metal to be used on fracture under tensile stress (see paragraph (c)(1) of this section).

(2) *Pressure relief.* The following pressure relief requirements apply to intermediate bulk containers intended for liquids:

(i) Intermediate bulk containers must be capable of releasing a sufficient amount of vapor in the event of fire engulfment to ensure that no rupture of the body will occur due to pressure build-up. This can be achieved by spring-loaded or frangible pressure relief devices or by other means of construction.

(ii) The start-to-discharge pressure may not be higher than 65 kPa (9 psig) and no lower than the vapor pressure of the hazardous material plus the partial pressure of the air or other inert gases, measured in the intermediate bulk container at 55 °C (131 °F), determined on the basis of a maximum degree of filling as specified in §173.35(d) of this subchapter. This does not apply to fusible devices unless such devices are the only source of pressure relief for the IBC. Pressure relief devices must be fitted in the vapor space.

[Amdt. 178–103, 59 FR 38068, July 26, 1994, as amended by Amdt. 178–108, 60 FR 40038, Aug. 4, 1995; Amdt. 178–117, 61 FR 50629, Sept. 26, 1996]

### §178.706 Standards for rigid plastic intermediate bulk containers.

(a) The provisions in this section apply to rigid plastic intermediate bulk containers intended to contain solids or liquids. Rigid plastic intermediate bulk container types are designated:

(1) 11H1 fitted with structural equipment designed to withstand the whole load when intermediate bulk containers are stacked, for solids which are loaded or discharged by gravity.

(2) 11H2 freestanding, for solids which are loaded or discharged by gravity.

(3) 21H1 fitted with structural equipment designed to withstand the whole load when intermediate bulk containers are stacked, for solids which are loaded or discharged under pressure.

(4) 21H2 freestanding, for solids which are loaded or discharged under pressure.

(5) 31H1 fitted with structural equipment designed to withstand the whole load when intermediate bulk containers are stacked, for liquids.

(6) 31H2 freestanding, for liquids.

(b) Rigid plastic intermediate bulk containers consist of a rigid plastic body, which may have structural equipment, together with appropriate service equipment.

(c) Rigid plastic intermediate bulk containers must be manufactured from plastic material of known specifications and be of a strength relative to its capacity and to the service it is required to perform. In addition to conformance to §173.24 of this subchapter, plastic materials must be resistant to aging and to degradation caused by ultraviolet radiation.

(1) If protection against ultraviolet radiation is necessary, it must be provided by the addition of a pigment or inhibiter such as carbon black. These additives must be compatible with the contents and remain effective throughout the life of the intermediate bulk container body. Where use is made of carbon black, pigments or inhibitors, other than those used in the manufacture of the tested design type, retesting may be omitted if changes in the carbon black content, the pigment content or the inhibitor content do not adversely affect the physical properties of the material of construction.

(2) Additives may be included in the composition of the plastic material to improve the resistance to aging or to serve other purposes, provided they do not adversely affect the physical or